1. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 5x^2 + 5x + 4$$

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 4}$

B. $\pm 1, \pm 5$

C. $\pm 1, \pm 2, \pm 4$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 5}$

E. There is no formula or theorem that tells us all possible Rational roots.

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2. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^3 + 39x^2 - 8x - 80$$

A. $z_1 \in [-1.1, -0.4], \ z_2 \in [0.56, 0.75], \text{ and } z_3 \in [3.49, 4.11]$

B. $z_1 \in [-2.6, -1.1], \ z_2 \in [1.59, 1.67], \text{ and } z_3 \in [3.49, 4.11]$

C. $z_1 \in [-4.7, -3.7], \ z_2 \in [-1.72, -1.42], \text{ and } z_3 \in [1.09, 1.96]$

D. $z_1 \in [-4.7, -3.7], \ z_2 \in [0.26, 0.56], \text{ and } z_3 \in [3.49, 4.11]$

E. $z_1 \in [-4.7, -3.7], \ z_2 \in [-0.77, -0.4], \text{ and } z_3 \in [0.37, 1.18]$

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3. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 - 92x^3 + 39x^2 + 270x - 200$$

A. $z_1 \in [-2.3, -1.61], \ z_2 \in [0.62, 0.99], z_3 \in [1.93, 2.23], \text{ and } z_4 \in [4.89, 5.01]$

B. $z_1 \in [-5.63, -4.89], \ z_2 \in [-2.34, -1.66], z_3 \in [-0.87, -0.67], \text{ and } z_4 \in [1.66, 1.72]$

C. $z_1 \in [-5.63, -4.89]$, $z_2 \in [-2.34, -1.66]$, $z_3 \in [-1.62, -1.11]$, and $z_4 \in [0.45, 0.77]$

D. $z_1 \in [-1.59, 0.58]$, $z_2 \in [1.2, 1.55]$, $z_3 \in [1.93, 2.23]$, and $z_4 \in [4.89, 5.01]$

E. $z_1 \in [-5.63, -4.89]$, $z_2 \in [-4.07, -3.93]$, $z_3 \in [-2.51, -1.78]$, and $z_4 \in [0.05, 0.48]$

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4. Factor the polynomial below completely, knowing that $x+2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^4 - 30x^3 - 92x^2 + 120x - 32$$

A. $z_1 \in [-2.17, -1.33]$, $z_2 \in [0.53, 1.48]$, $z_3 \in [1.78, 2.63]$, and $z_4 \in [2.42, 2.65]$

B. $z_1 \in [-4.85, -3.25]$, $z_2 \in [-2.97, -1.92]$, $z_3 \in [-0.16, 0.52]$, and $z_4 \in [1.76, 2.05]$

C. $z_1 \in [-3.07, -2.47]$, $z_2 \in [-2.97, -1.92]$, $z_3 \in [-1.63, -1.11]$, and $z_4 \in [1.76, 2.05]$

D. $z_1 \in [-2.17, -1.33]$, $z_2 \in [0.34, 0.92]$, $z_3 \in [0.39, 0.81]$, and $z_4 \in [1.76, 2.05]$

E. $z_1 \in [-2.17, -1.33]$, $z_2 \in [-1.63, -0.5]$, $z_3 \in [-0.48, -0.13]$, and $z_4 \in [1.76, 2.05]$

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{16x^3 - 52x^2 + 46x - 15}{x - 2}$$

A. $a \in [32, 37]$, $b \in [8, 16]$, $c \in [69, 71]$, and $r \in [122.2, 127.7]$.

B. $a \in [14, 24]$, $b \in [-23, -12]$, $c \in [6, 7]$, and $r \in [-4.3, -0.7]$.

C. $a \in [14, 24]$, $b \in [-37, -31]$, $c \in [8, 14]$, and $r \in [-6, -4.3]$.

D. $a \in [14, 24]$, $b \in [-88, -80]$, $c \in [210, 216]$, and $r \in [-444, -440.8]$.

E. $a \in [32, 37],\ b \in [-117, -112],\ c \in [275, 283],$ and $r \in [-571.4, -568.5]$.

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 42x^2 - 34}{x + 4}$$

A. $a \in [9, 11], b \in [-9, -7], c \in [39, 41],$ and $r \in [-237, -229]$.

B. $a \in [9, 11], b \in [2, 6], c \in [-9, -7],$ and $r \in [-7, 2]$.

C. $a \in [-42, -35], b \in [-123, -117], c \in [-484, -465],$ and $r \in [-1925, -1919]$.

D. $a \in [9, 11], b \in [81, 85], c \in [327, 330],$ and $r \in [1277, 1283]$.

E. $a \in [-42, -35], b \in [198, 207], c \in [-810, -806],$ and $r \in [3198, 3204]$.

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 - 28x^2 + 18}{x - 2}$$

A. $a \in [10, 14], b \in [-7, -3], c \in [-9, -5],$ and $r \in [-2, 9]$.

B. $a \in [10, 14], b \in [-52, -47], c \in [99, 105],$ and $r \in [-191, -188]$.

C. $a \in [10, 14], b \in [-16, -12], c \in [-16, -10],$ and $r \in [-2, 9]$.

D. $a \in [24, 28], b \in [18, 24], c \in [32, 42],$ and $r \in [94, 102]$.

E. $a \in [24, 28], b \in [-78, -75], c \in [145, 153],$ and $r \in [-289, -284]$.

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 3x^3 + 4x^2 + 2x + 4$$

A. $\pm 1, \pm 3$

B. $\pm 1, \pm 2, \pm 4$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 3}$

D. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 4}$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 25x^2 - 20x - 18}{x + 2}$$

A. $a \in [10, 18], \; b \in [-25, -12], \; c \in [40, 42], \;$ and $r \in [-140, -137]$.

B. $a \in [10, 18], \; b \in [-7, 0], \; c \in [-11, -8], \;$ and $r \in [2, 4]$.

C. $a \in [10, 18], \; b \in [52, 58], \; c \in [85, 91], \;$ and $r \in [160, 168]$.

D. $a \in [-35, -26], \; b \in [-39, -30], \; c \in [-93, -85], \;$ and $r \in [-198, -197]$.

E. $a \in [-35, -26], \; b \in [83, 90], \; c \in [-190, -185], \;$ and $r \in [360, 364]$.

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10. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^3 - 123x^2 + 121x - 30$$

A. $z_1 \in [0.7, 2.1], \; z_2 \in [2.4, 2.6], \;$ and $z_3 \in [4.71, 5.05]$

B. $z_1 \in [-5.8, -3.8], \; z_2 \in [-2.7, -1.6], \;$ and $z_3 \in [-1.34, -1.16]$

C. $z_1 \in [-5.8, -3.8], \; z_2 \in [-1.5, -0.6], \;$ and $z_3 \in [-0.48, -0.32]$

D. $z_1 \in [-0.4, 0.7], \; z_2 \in [0.5, 2], \;$ and $z_3 \in [4.71, 5.05]$

E. $z_1 \in [-5.8, -3.8], \; z_2 \in [-3.3, -2.8], \;$ and $z_3 \in [-0.11, -0.07]$
